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APPENDIX No. 22.

PACIFIC RAILWAY.

CANADIAN PACIFIC RAILWAY.

OFFICE OF THE ENGINEER IN CHIEF.

OTTAWA, January 4, 1878.

SIR,—I have the honour to report on the progress made in surveying operations and construction to the 31st December, 1877.

SURVEYS IN THE EASTERN OR WOODLAND REGION.

In the season of 1876, a trial location survey was made from the proposed Eastern terminus, near Lac Amable du Fond, about 23 miles south-east of Lake Nipissing, to Cantin's Bay on French River, and from this line, explorations were made of the country extending northwestward, on a course as direct as practicable to a point on the north shore of Lake Superior near the mouth of the River Pic.

These explorations were not completed; and portions of the trial location above referred to were not satisfactory, as the low gradients that had been expected were not obtained.

During the past season, four surveying parties were employed in completing these exploratory surveys, and improving the location of the line of the previous year. The plans and profiles are in progress, and the following is an outline of the results of the season's work.

Location of the line from South River to Cantin's Bay on French River.

This line commences at a point on South River about 3 miles from its mouth on Lake Nipissing, and 22 miles north-west of Lac Amable du Fond, where the survey of the previous year commenced. It follows down the left bank of the river to the shore of Lake Nipissing; thence it takes a course nearly west to the 20th mile, from which its course is south-west to the 35th mile, where it joins the survey of the previous year, and then follows that line on a course nearly west to the head of Cantin's Bay, 49½ miles from the point of beginning. If extended to the foot of the bay, its length will be 55½ miles.

This bay—a sheet of water about 5 miles in length, and averaging nearly a quarter of a mile in breadth—lies at the confluence of the Pickeral and south branch of French River, about 20 miles from the mouth of the latter on the Georgian Bay. Its altitude varies from 4 to 6 feet higher than that of the latter; so that to extend the navigation of the Georgian Bay to Cantin's Bay, a lock would be required to surmount the rapids near the mouth of the river, the rest of the distance being still water; it is, in fact, a long, narrow lake.

The country traversed is generally rocky, and broken up with numerous lakes and small streams running in narrow valleys or ravines.

The altitude at the starting point on South River is estimated 678 feet above sea level, being 530 feet lower than that of Lac Amable du Fond, and the highest point on the line is 813 feet, being 407 feet lower than the summit altitude of the line of the previous year. But still the proposed maximum gradient of 1 in 200, or 26.40 feet per mile, has not been obtained. The gradients can, however, be kept down to a maximum of 1 in 150, or 35.20 feet per mile, rising eastward, without involving very heavy works. Of this gradient of 1 in 150 there are ten separate lengths,

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making a total of about 8 miles. In descending to Cantin's Bay, however, the grade is 1 in 133, or 39.60 feet per mile; but it is expected that this can be reduced by slight deviation, and lengthening of the line. Of the maximum of 1 in 100, rising westward, there are seven short lengths, making an aggregate of $5\frac{1}{4}$ miles.

The works will be generally lighter than on the corresponding length of the surveyed in 1876. The heaviest will be in rock cuttings, running from 5 to 25 feet of maximum depth, and 300 to 800 feet in length, with embankments of somewhat larger dimensions. There will be about 12 miles on which work of this character will occur, and 14 miles on which there will be rock cuttings varying from 6 to 25 feet of maximum depth, and averaging about 500 feet in length. The balance will be moderately light work.

The principal bridging will be as follows:—

Beatty's Creek.—Ravine 250 feet wide with a maximum depth of 40 feet.

Commando Creek.—Breadth of valley 620 feet, maximum depth 62 feet, breadth of stream 120 feet.

Outlet of Lake Mahmasagamising.—One span of 100 feet.

Pickerei River.—One span of 150 feet.

Pickerei River branch.—Breadth of ravine 220 feet, maximum depth 35 feet, breadth of stream 40 feet.

In addition to these, there will probably be some bridging required in ravines where materials for embankments cannot be obtained in the vicinity.

Surveys and Explorations from French River to Lake Superior.

Exploratory surveys have been made of two lines extending westward from different points on the line last described, and meeting at a common point in the valley of the Wahnapiitapee.

The northern, and most direct, line diverges at the 19th mile of the located line and takes a general course a little to the north of west. Continuing the mileage from French River (Lake Nipissing) it crosses the main branch of French River near the 26th mile, at the Chaudière Falls, where the trough of the river is contracted to 20 feet, and the breadth of the stream to 50 feet. Near the 29th mile, it strikes the north branch of this river, and follows down its left bank to the 34th mile, where the line crosses the river, which at this point is 200 feet wide, and 10 feet deep.

At the 39th mile, it crosses another arm of French River, 200 feet wide; then it follows a chain of narrow valleys which are separated by low rocky ridges. Near the 61st mile, it crosses Lake Maskinonge, 1700 feet wide and 18 feet deep, which can however be reduced by drainage. The line reaches the Wahnapiitapee Valley at the 72nd mile.

There is very little variation in the altitude of the country throughout this section and the gradients are generally easy. The works would be variable, as the line alternately runs in the valleys or across intervening ridges. There will be an aggregate of about 11 miles on which rock cuttings varying from 5 to 15 feet of maximum depth, but in short lengths, would occur. On the rest of the line the works would be medium or moderate.

The southern line leaves the located line at the 48th mile near the head of Cantin's Bay, and within half a mile it crosses the Pickerei River, which is here 200 feet wide and 5 feet deep. It then follows the north shore of Cantin's Bay, and crosses the main branch of French River at the Horse Rapids, where the channel is 200 feet wide. Near the 55th mile, it crosses another branch of this river, 40 feet wide and at the 57th mile it crosses the north branch, where the channel is 250 feet wide.

Thence, the line takes a generally north-westward course, following a chain of narrow valleys and lakes. It crosses the south end of Lac de l'Isle at the 74th mile and following another chain of valleys and flats, separated by rocky ridges, it joins the line last described near the 81st mile.

This is $9\frac{1}{4}$ miles longer than the northern line, but the whole of it would be part of the main line, while the northern would have a branch of 30 miles to Cantin's Bay, making $20\frac{3}{4}$ miles more line to be constructed. The gradients on this line are very

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REPORT ON SURVEYS OF THE RAILWAY

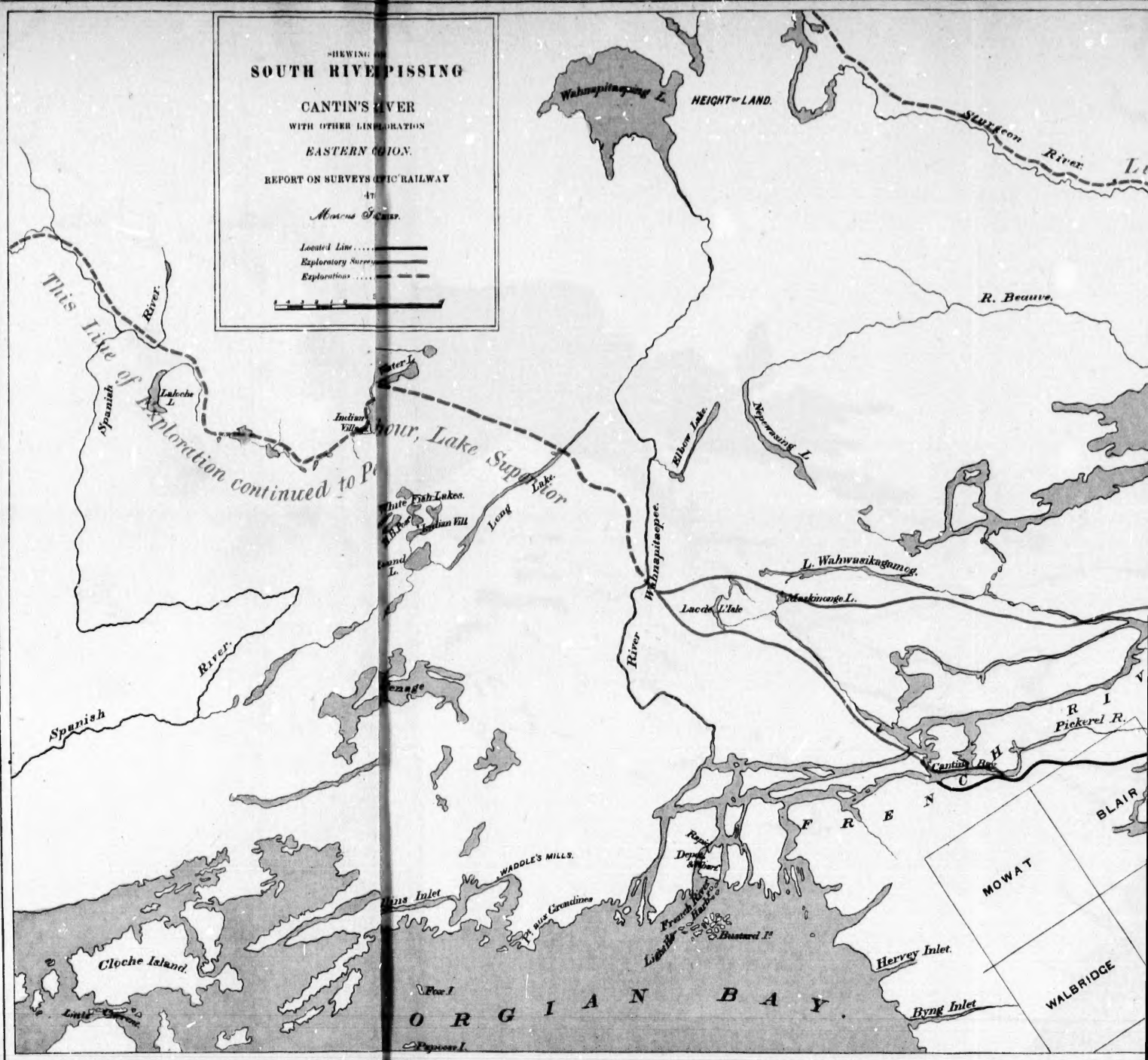
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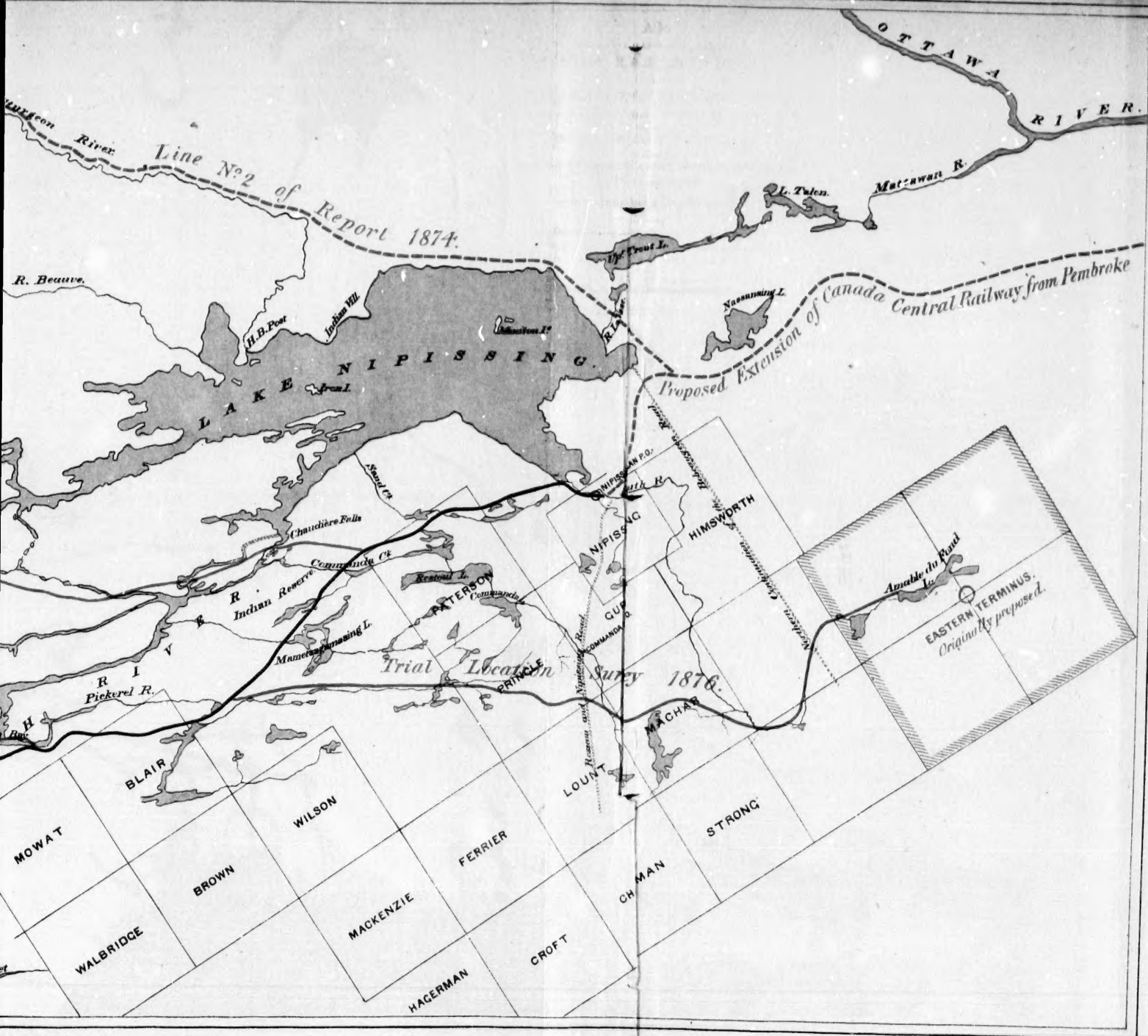
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On both lines there are detached tracts of land fit for cultivation, with spruce, amarae, cedar, birch and poplar, which would furnish railway ties. There is a small quantity of hemlock and pine, but most of the latter has been burnt off by bush fires. On Cantin's Bay and near the Chaudière Rapids, there are large patches of sugar maple.

Explorations with barometer and compass.

The altitudes and distances from this forward must be taken as approximate. The distances hereafter referred to are estimated from the starting point of South River by the northern or direct route.

The River Wahnapitewee is 200 feet wide where the line crosses it, and the altitude is 632 feet above sea level. Thence the line of survey takes a general north-east course, ascending diagonally the slope or water shed of Lake Huron over a rough and rocky country intersected with numerous, narrow, trough-like valleys, and indented with lakes and swamps, rocky ridges intervening. Still, a feasible line has been found without very high gradients or exceptionally heavy work up to the Vermilion River, at the 106th mile. At the 85th mile it crosses the long valley running in a south-west direction, in which lies the chain of narrow lakes known as Long Lake. The altitude at this point is 810 feet. The rocks up to the 97th mile are generally gneissoid, but westward of this, slate is the characteristic of the country. The highest point on this section is at the 97th mile, where the altitude is 1010 feet: the crossing of Vermilion River, 106th mile, near the foot of Vermilion Lake, it is 6 feet.

The line follows the north shore of Vermilion Lake 4 miles, then crosses a hilly rocky tract to Spanish River, which is reached at the 135th mile, altitude 1070 feet. Between this and the River Aux Sables, the country is very rough, and the course of the line tortuous.

The ascent is by terraces, and in some places is very abrupt, more especially from the 147th mile to Rocky River at the 160th mile, where the altitude is 1411 feet. There will be some high gradients, and a large proportion of heavy works throughout the section from Vermilion River to the River Aux Sables. At the 175th mile, the line crosses this river near the foot of Lake Aux Sables, altitude, 1512 feet. This is near the water shed between Lake Huron and Hudson's Bay. Thence its course is more uniform, and there is very little variation in the altitude for the next 100 miles, but the gradients are very easy, and the works will be generally light or medium.

The line strikes the River Epinette at the 204th mile, about a mile above its confluence with the Mississauga. Thence it follows up this stream, and its affluent the French River, to the source of the latter in Lake Wagong at the 220th mile, where the altitude is 1440 feet. It crosses the River D'Embarras at the 222nd mile, and passes the head end of Lake Winnibegon at the 235th mile. The River Montreal, Lake Superior, is crossed at the 274th mile, altitude 1410 feet, and the Shequamkah at the 281st mile, where the altitude is 1345 feet.

On the last 12 miles the plateau is broken by numerous detached hills rising to a height of 300 or 400 feet. To avoid these, the curvature of the line would be increased, and the works would be heavier than on the rest of the plateau.

From the Shequamkah to Lake Superior a new line was explored during the last season, keeping more to the north than that of 1876, passing by the head of Dog Lake, the valley of White River, and thereby avoiding the high ground east of Sand Lake River.

The line, however, is still open to objection in many parts. The country is intersected at intervals by deep valleys and high rocky ridges, often at nearly right angles to the general course of the line, causing great variations of altitude and a large amount of curvature, with occasional high gradients, involving a considerable proportion of heavy works.

At the 306th mile, the line reaches the valley of the Michipicoten near the foot of White Fish Lake, an expansion of the river, altitude 900 feet.

The River Magpie is crossed at the 335th mile, where the altitude is 963 feet. The highest intermediate point is 1,230 feet at the 318th mile.

From the Magpie to the head of White River at the 370th mile, the course of the line is tolerably direct, with generally easy gradients, and the works would not be heavy. The altitude at this point is 1,380 feet. Thence the line follows down the valley of White River to the 417th mile, where the altitude is 1,060 feet. There is a large amount of curvature in this section, but with easy gradients, and the work would be moderately light.

From White River to the River Pie, at the 440th mile, the country is rough and full of hills, the line tortuous, with high gradients, and the works generally would be rather heavy.

The last point is on the same level as Lake Superior, 600 feet. Thence the line passes through a valley to Heron Bay, and follows the shore of Lake Superior to Peninsular Harbour, where it joins the survey of 1874, at the 452nd mile. The shore of Lake Superior from Peninsular Harbour to the River Nepigon is deeply indented with numerous bays, coves and bights surrounded by high rocky bluffs, involving large amount of curvature on the line with occasional high gradients, and, in construction, a large quantity of rock excavation with a number of short tunnels. (Vide Report of 8th February, 1877, pages 206 to 210.)

The line crosses the River Nepigon near the foot of Lake Ellen, to which the length from South River is 569 miles; and if it were extended to a common point near the south-east angle of Lake Nipissing, it would be 26 miles longer than the line No. 2, explored in 1873. (Vide Report of 26th January, 1874, page 205.)

Following the exploratory survey of 1874 from the River Nepigon *via* Do Lake to a point on the line under construction from Fort William westward, the total length would be, approximately, 661 miles.

These exploratory surveys show that a feasible line, with fair gradients and only a moderate proportion of rather heavy works, can be obtained from South River to Vermilion Lake, 106 miles. But between that point and the high plateau reached at Lake Aux Sables at the 175th mile, the country is not so favourable. The course of the line is tortuous, the rise occasionally abrupt, requiring high gradients and a considerable proportion of the works would be heavy.

The almost uniform altitude of this plateau or watershed for a long distance the line explored, and at different points where it has been crossed by previous surveys, suggests the course of avoiding the heavy works on the shore of Lake Superior by diverging from the present line at some point in the vicinity of Lake Winnibegon, and following the watershed which trends more to the northward, Long Lake, and there joining the line No. 2 of the survey of 1873. Thence, it follows that line to the crossing of River Nepigon near its outlet from Lake Ellen.

If this were found favourable, we should then have the choice of two feasible lines between the south-east angle of Lake Nipissing and the River Nepigon; one passing the south of Lake Nipissing and the watershed between Lakes Huron and Superior and Hudson's Bay; the other running to the north of Lake Nipissing, and generally north of the watershed.

SURVEYS ON THE CENTRAL OR PRAIRIE REGION.

During the past season, surveys have been made with the view of improving the crossings of some of the rivers and deep ravines in this region, with the following results:—

South Branch of the Saskatchewan; at the 878th mile, from Fort William, Lake Super

The eastern approach to this river can be improved from a gradient of 0.75 mile to 100 to one of 0.50 per 100, or 26.40 feet per mile; but the line will be lengthened about a mile and one third, and the formation level above the bottom of the valley raised from 88 to 95 feet.

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By former surveys, the breadth of the Coulé or trough was 2200 feet at the top 1000 feet at the bottom, and 155 feet deep. By the last survey it is 2400 feet wide at the top, 1200 feet at the bottom, and 125 feet deep. Neither the rate of the gradients nor the quantity of excavations in the approaches has been increased.

The summit altitude, west of the Coulé at the 1087th mile, has been reduced 54 feet, and the gradients have been improved.

Buffalo Coulé at the 1101st mile.

The breadth of this, by former surveys, was 1600 feet at the top, 700 feet at the bottom, and 100 feet deep, which is reduced by the last survey to 1200 feet at the top, 600 feet at the bottom, and 90 feet in depth.

Suggested deviation of the line from Selkirk westwards, passing south of Lake Manitoba.

In accordance with the verbal instructions of the Minister, an examination has been made of this line, with instrumental surveys of some of the deep valleys traversed by the line, and at other places where deemed necessary.

The deviation from the located line commences at the crossing of the Red River, and takes a south-westerly course till it reaches the centre of the range of townships lying north of the fourth base line; thence it follows due west on or alongside a road allowance through the centre of this range nearly up to the valley of the Little Saskatchewan. Thence, continuing westward, it crosses the Assiniboine at a point above the junction of Qu'Appelle River and through the Touchwood hills to the Elbow of the North Saskatchewan at Caerlaverock.

The line throughout the Province of Manitoba, nearly 100 miles, is very favourable for railway construction, and the land is generally fertile. West of the Province Line the country is more broken, and the land becomes poorer.

The first serious difficulty is the crossing of the valley of the Little Saskatchewan, which is nearly a mile wide at the top, sloping gradually down to the river, where the valley is 225 feet deep. As it is obviously impracticable to cross this at right angles without enormously heavy works, the course of the surveyed line was deflected so as to follow obliquely down one side of the valley and up the other, by which the maximum gradient on the east side was reduced to 0.75 per 100, or 39.60 feet per mile for five miles in length, and on the west side to 1 per 100, or 52.80 feet per mile for a little over 4 miles in length. Thus it requires over 9 miles to cross this valley, carrying the line out of the direct course, which, together with the unavoidable curvature, will increase its length considerably.

The valley of Birdtail Creek, at the point crossed by this route is three quarters of a mile wide, and 190 feet deep in the centre.

The valley of the Assiniboine is over a mile wide, sloping abruptly down to the bottom flat, which is over 200 feet below the level of the plain. The river is 300 feet wide at flood, where it is crossed by a bridge near Fort Ellice.

No instrumental survey was made of these valleys, but they could probably be crossed in the same manner as the Little Saskatchewan.

The valley of Cut Arm Creek is over 100 feet deep where the trail crosses it.

The Touchwood Hills could be crossed without exceptionally high gradients, but with some rather heavy excavations; and the line would be sinuous, and consequently longer, than if a direct course were practicable.

Thence, to the bend of the North Saskatchewan at Caerlaverock, the country is similar to that traversed by the located line. A large proportion of the land on this side is only fit for pasture, and much of it is sandy or light soil, producing short grass. Among the Touchwood Hills, and in their vicinity, there are some tracts of good land for cultivation.

Deviation to Quill Lake.

An alternative line in the same general direction, may be thus described:— Following the course of the last line up to the Little Saskatchewan, it there deflects to the north-westward, crossing the Assiniboine near the mouth of Shell River; thence, passing to the north of the Touchwood Hills it joins the located line near Quill Lake.

The valley of Bird Tail Creek, where this line crosses, is nearly a mile wide at the level of the plain, and slopes gradually down to the river, where it is 175 feet deep. This could be approached on the east side by a narrow lateral valley, but there is no corresponding valley on the west side.

The valley of Shell River where the line strikes it, is 250 feet deep, over a mile wide at the top, and 1,000 feet on the bottom flat. It is possible to descend by the slope of this valley to the bottom flat of the Assiniboine Valley, and after crossing that, to ascend by a lateral valley to the table land on the west side; this, however, can only be done by using high gradients, and with a large amount of curvature, by which the length of the line would be considerably increased. Some of the gradients used on the survey were 70 feet to the mile; these, however, can probably be reduced to 1 per 100 or 52·80 feet per mile, but only with very heavy excavations.

The rest of the line to Quill Lake is favourable; a considerable proportion of the land is fit for cultivation; of the balance, some is good pasture land, the rest very poor.

It should be observed that the Engineer in Chief fixed the maximum gradient at 0·50 per 100 = 26·40 feet per mile rising eastward, and 1 per 100 = 52·80 feet per mile rising westward, and on the located line these gradients have been maintained to a point west of Battleford. They could not, however, be maintained on the line suggested; even with very heavy works a gradient of 1 per 100, each way, is the best that can be had for many miles.

This, together with the increased length caused by curvature and deflections from the general course, would render the line suggested much inferior to the located line for the economic working of the traffic, and would add considerably to the cost of moving to the seaboard the produce of the large and rich agricultural tracts lying farther to the north-west.

There are no data for estimating the difference of the cost of construction in the two lines, but this is a point of less importance than economic working after construction.

Comparing the extent of good lands that would be crossed by the located line and the suggested deviations, the latter have probably the advantage for the first 100 miles, viz., to the western boundary of Manitoba, as the lands of the Province are generally fertile, and in the portion that would be traversed by the lines proposed, they are comparatively dry and free from timber, and are, therefore, eligible for rapid settlement; a good system of drainage, however, is required throughout the Province.

The located line also crosses large tracts of good land; and it should be borne in mind that even the *muskegs* or swamps, which are found on both lines, will make good meadow land when drained, as they are not deep: the side ditches of the Railway alone will effect a great improvement in this respect, as they have done elsewhere. There is a considerable quantity of wood lands on the located line, chiefly poplar, which may possibly oppose certain difficulties to settlement, but which undoubtedly offers compensating advantages.

Beyond the first 100 miles from Selkirk there is a long stretch of land, of inferior and variable quality on both lines. But at the valley of Swan River the located line enters on a very extensive fertile tract. On the suggested deviations, after passing the Province Boundary, the quality of the land becomes inferior, and only a small proportion is fit for cultivation westward up to the bend of the North Saskatchewan.

On the deviation from the Little Saskatchewan, north-westward to Quill Lake, there are considerable tracts of good land fit for cultivation.

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A line drawn from the mouth of the branches of the Saskatchewan River to about the north-east corner of the prairie, and pass 15 to 20 miles from this line were extended to the Lesser Slave Lake, it would show the general character of the North West Territory. The soil will be uniform, and the water intersected and controlled. The soil is of variable quality. Both the quality of the soil and the north-west; whilst the productive powers of the land are not uniform.

A branch line meets the requirements of the main line, which, if it meets the interests of the Dominion.

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This seemed to indicate that the fertile belt trends to the north-west, and a more extended examination of the country was accordingly made, by which this view was confirmed.

A line drawn from Winnipeg to Fort à la Corne near the confluence of the two branches of the Saskatchewan, would cut off the south-west angle of Lake Manitoba, skirt the north-eastern base of Riding Mountain, cross the north end of Duck Mountain, and pass 15 to 20 miles north of Fort Pelly and across the Basquia Hills. If this line were extended through the Beaver Valley to Lac la Biche, thence by the Lesser Slave Lake, so as to intersect the Peace River near the mouth of Smoky River, it would show the general course of the great fertile belt of agricultural lands in the North West Territory. It is not to be expected that in a stretch of over 1,000 miles the soil will be uniformly good. The fertile belt is accordingly very irregular, often intersected and contracted by *muskegs* and lakes, and low ranges of hills on which the soil is of variable quality; there are, however, vast tracts of extraordinary fertility. Both the quality of the soil and the salubrity of the climate improve towards the north-west; whilst investigations have shown that even beyond Peace River, the productive powers of the land are astonishingly great.

It is evident that no single line of railway can traverse all the fertile portions of a region so extensive, and that even before the trunk line is complete, branches will be required in various directions.

A branch line could be constructed, at a comparatively small cost, to meet the requirements of the Province of Manitoba equally well as a diversion of the main line, which, if carried out as suggested, could not fail to be injurious to the wider interests of the Dominion.

From all the information obtained up to this time, it does not appear advisable that any alteration should be made in the line as located in this district. There, however, appears to be a feasible line, which, after passing the south end of Lake Manitoba, takes a north-westerly course, skirting the eastern base of Riding Mountain and the north end of Duck Mountain, and joining the located line in the valley of Swan River.

The country is described as level and thickly wooded with spruce, poplar and some maple. (*Vide* Report of April 10th, 1872: Page 56.) Small lakes surrounded by extensive marshes are, however, found throughout this district.

The line suggested would be from 20 to 30 miles longer than the located line, but the gradients would probably be good, and the works moderately light, and it would, therefore, be somewhat less open to objection than the other deviations proposed.

SURVEYS IN THE WESTERN OR MOUNTAIN REGION.

During the season of 1877, the writer travelled over the route from the Saskatchewan, *via* the Yellowhead Pass, and the valleys of the Thompson and the Frazer to the Pacific coast, and closely examined the line at most of the difficult points of the survey. A complete location survey was made of that portion of the line from Tête Jaune Cache to Burrard Inlet, by which some of the difficulties and heavy work met with in former surveys have been avoided or reduced and the line generally much improved. When the plans and profiles are completed, and the quantities of the several classes of work got out, they will furnish better *data* for making an estimate of the cost of construction than have hitherto been obtained. A description of this survey by Mr. H. J. Cambie is appended.

EXPLORATION OF THE SKEENA ROUTE.

At the outset, it became evident that there is no harbour at the mouth of the Skeena suitable for a railway terminus. A fair anchorage is to be had in Cardena Bay, at the southern end of Kennedy Island, but it would be extremely difficult, if not impracticable, to reach that neighbourhood with a railway line.

Attention was therefore directed to Port Simpson, at the northern end of the Simpson Peninsula, a well known and excellent harbour, and on examination it was found that there are no great obstacles to carrying a line along the north side of the Peninsula to that point.

The distance is probably 10 miles longer than to Cardena Bay, but, of the two. This harbour is far better adapted for commercial purposes, and the cost of constructing the railway would probably be much less.

Engineering Features.

From Port Simpson, for about 35 miles along the north side of the Tsimpson Peninsula, and across the dividing ridge, 250 feet high, to the banks of the Skeena, the works would be heavy.

In ascending the Skeena through the Cascade Mountains the works would generally be heavy, but less so than by either the Fraser or Homathco valleys, through the same chain of mountains.

For the first 35 miles the hills descend in steep inclinations to the water's edge, and there are indications of snow slides at several points. The valley averages a mile in breadth, but the river is thickly studded with islands, and has channels reaching the base of the mountains on either side.

Above this, for a distance of about 80 miles till the eastern face of the Cascade range is reached, the valley narrows a little, but the side hills are not so steep. The valley then opens out somewhat, and the works would be moderate for about 40 miles, which distance would bring the line to the Forks of the Skeena, near which there is an Indian Village named Kitma on the map.

The elevation at this point is about 700 feet above sea level, and the gradient would be very easy throughout the whole distance from the seaboard.

The general course of the line up to this point has been north-east, but here it leaves the Skeena and takes a south-east course at right angles to the former, ascending the valley of the Watsonquah, which for the first 27 miles is principally a canyon, and would require stiff gradients and heavy works in places.

The remainder of the distance *via* Lake Fraser to the valley of the Nechako would have easy gradients with moderately light works. The summit altitude between the Skeena and Nechaco, is only 2,400 feet above sea level. In this valley a junction is made with the previously surveyed line from Yellowhead Pass. (*Vide Report* February 8th, 1877, pages 274-276.)

Several attempts were made to find a pass leading directly from the Skeena to Lake François, so as to avoid the angle between the former and the Watsonquah, but so greatly reduce the length of the line, but without success, as the space contained within the angle is a compact mass of high mountains.

The distances from a common point at the mouth of the Chilacoh, near Fort George, are as follows:—

	Miles.
To Fort Simpson, approximately.....	430
To Bute Inlet, by measurement.....	289
To Dean Inlet, by measurement.....	231

Fort Simpson is, however, much nearer to the Asiatic coast, the distances to Yokohama being as follows:—

	Statute miles.
From Fort Simpson.....	4,450
From Kamsquot Harbour, Dean Inlet.....	4,720
From Waddington Harbour, Bute Inlet.....	4,836

Character of the soil, &c.

There is a small area of land in the neighbourhood of Port Simpson fit for cultivation. In the lower part of the Skeena, many of the islands with which it is studded, consist of rich alluvial soil, but they are subject to overflow at high water. For 15 or 20 miles below the Forks of the Skeena, and for some distance above the point, the hills do not approach the river within two or three miles on either side. The land is of fair quality, and covered with a light growth of poplar, birch and

ent, of the tunc. There are some settlements at the Forks of the Skeena, where there was
st of construc crop of oats, almost ripe, on the 31st July, and also abundant crops of potatoes,
ots, cabbage, &c.

The slopes of the Watsonquah Valley throughout its length are, in part, prairie,
sustain a magnificent growth of grass fit for pasture. The roots of the grass
twine and form a sod, so that it would not be killed off by allowing cattle or
the Tsimpsee to crop it closely, as bunch grass is.

of the Skeena This part of the country is, however, subject to summer frosts, which would
lar it unfit, or at least unreliable, for purposes of agriculture.

rs would gen
ys, through t

Timber.

A tree commonly called "yellow cypress" is found on the lower Skeena, which
e water's edge great strength and density of fibre, and is said to be extremely durable, but
ley averages quantity is so limited that it may be said to have little commercial value. The
channels was remark would apply to hemlock, though it was seen in some places of great

On most of the islands subject to overflow, very fine cottonwood trees are to be
of the Cascade, which may be utilized at some future time for the same purpose to which
so steep. Twood and whitewood are applied in the Province of Ontario.

about 40 mil
which there

Snow Fall.

Through the Cascade mountains, the snow in places lies to a depth of 7 or
d the gradient on the level. From the Forks of the Skeena to the River Fraser, it is said not
exceed 3 feet in depth, except on very rare occasions.

st, but here
former, ascer

Minerals.

ally a cany Marble was seen in beds of great thickness, varying in colour from purple to
f the Nechaco to. Some ores of copper and lead were also observed, but not in veins of any
titude betw at thickness.

alley a juncti
(Vide Repo

EXPLORATION OF THE PINE RIVER PASS.

The highly favourable reports received respecting the character of the Peace
the Skeenaer District, and the prospects held out of a satisfactory route being obtainable
atsonquah, ough the Pine River Pass, made it expedient to obtain further information in that
pace contain on. Accordingly, the exploration was extended from a point in the neighbour-
of Lake Fraser, rid the east end of Lake Stewart, to Fort McLeod on the
coh, near Fenip, or south branch of the Peace River.

This route proved very unfavourable for railway construction: subsequently,
ever, a good connecting line, though more circuitous, was found by following
n the Nechaco and the Stewart Valleys nearly to Fort George; thence, in a
herly direction, up the valleys of the Fraser and Salmon Rivers, and across the
watershed to Summit Lake, one of the sources of the Parsnip, which river was
followed down to Fort McLeod.

Beyond the existence of an Indian trail across the Rocky Mountains from Fort
Leod to Fort St. John, very little was known; nor was any information obtain-
in the neighbourhood respecting the Pine River Pass, except through an old
an woman, who drew a sketch on the sand, and explained it to the best of her
ity.

With the scant information thus obtained, the exploration was continued from
McLeod eastward: following up the valley of the River Misine, nea, an affluent
e Parsnip, till an altitude of 5,500 feet was reached without any ppearance of a

On descending the river, a stream was discovered falling into it from the
h, about 35 miles above its confluence with the Parsnip. Following this up four
s, it was found to issue from a small lake named Azuzetta. This proved to be
the summit of the Pine River Pass, its altitude being estimated at 2,430 feet above
level of the sea.

A little beyond this the head waters of the Pine River were struck, and the

river followed down eastward to the Forks, a point reached by Mr. Selwyn's canoe from the Peace River in 1875. (*Vide* Geological Survey of Canada, Report Progress for 1875-76, pages 52 to 54.)

The exploration was continued 30 miles eastward of the Forks on to the Beaver Plains, which lie between the Rocky Mountains and Peace River.

Thus the question of the feasibility of the Pine River Pass is at last settled. The full Report has not yet been received, but the distance between Fort McLeod on the west side of the Mountains, and the Forks of Pine River on the east side, is estimated at 90 miles.

The gradients are stated to be generally easy with the exception of a few miles near the summit of the pass where they will probably be about 60 feet to the mile, and the works in the construction of a railway would be moderately heavy except for a length of about eight miles near the summit of the Pass, and a longer length at the Forks of Pine River, where they would be heavy.

The land in the Pine River valley for 50 miles above the Forks is of excellent quality, and well suited for agricultural and grazing purposes.

It should be observed that this fertile strip of land, lying nearly in the heart of the Rocky Mountains, is an extension of the Beaver Plains which connect the great fertile belt, stretching from Manitoba to and beyond the Peace River.

Should the engineering character of a line by this route prove on closer examination as favourable as reported, the results from this exploration will be amongst the most important that have been obtained since the commencement of the surveys. Some of the serious difficulties in crossing the Rocky Mountains will have disappeared, and the formidable chain, once held to be insurmountable, and even now felt to be an obstacle to railway enterprise, can then be passed with very favourable gradients and with works not exceeding in magnitude those generally required on other routes of the line.

In addition to the manifest advantages offered by this route, there is further an important consideration that in place of a bleak sterile country, wherein settlement is an impossibility for hundreds of miles, the line would traverse an area of remarkable fertility, with but a few short intervals of country unfit for settlement. This line also passes between the vast mineral districts of Omineca and Cariboo. The extraordinary results of recent mining operations in the latter give promise, when their resources are more fully developed—as they can only be with the assistance of direct railway communication—of rivalling, if not surpassing, the far-famed gold and silver regions of the neighbouring States, which lie in the same mountain zone.

Port Simpson may possibly be considered, at present, too far north for the terminus of the Canadian Pacific Railway, but it is important that the fact should be kept in mind, that by virtue of low altitudes and consequent easy gradients, together with the comparatively moderate character of the works required to reach it, this terminus point offers advantages which would enable a Canadian line to defy competition for trade with China and Japan, Port Simpson being fully 500 miles nearer to Yokohama than Holme's Harbour, at the mouth of Puget Sound, the proposed ultimate terminus of the Northern Pacific Railway, while the advantage it possesses over San Francisco is correspondingly greater.

But the Pine River Pass is not merely the key to Port Simpson; it affords a comparatively easy communication with Bute Inlet, and all the intermediate points between that point and Port Simpson, the valleys of the rivers leading to these points radiating from the Stewart Valley, south-west of the Pass, with exceptional directness. Thus many of the difficulties in the way of reaching Bute Inlet and the coast to the north of it, *via* the Yellowhead Pass, can be avoided, and this probably without increasing the length of the line.

The distance from Livingstone on the located line, over the Yellowhead Pass, to the confluence of the Chilacooh and Stewart Rivers, near Fort George, is 1,029 miles. The distance between the same points *via* the Pine River Pass measures on the located line, so nearly the same as the above that a survey alone can determine the precise difference between the two routes.

r. Selwyn
Canada, Rep

WORKS OF CONSTRUCTION.

TELEGRAPH LINE.

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Commencing at Fort William, the line is erected to a point named "Falcon," a distance of 137 miles, and is in operation to English River, 113 miles. Between Fort McLeod and Keewatin, 160 miles, considerable clearing has been done, and a line has been laid for a distance of 30 miles eastward from Keewatin. Between Keewatin and Selkirk, 112 miles, the line is erected and in operation. It is expected that the connection between Fort William and Selkirk will be completed during the winter. The line is erected and in operation between Selkirk and Livingstone, 271 miles, where it crosses certain lakes, ponds and marshes, a number of the poles require to be permanently secured. The branch line between Selkirk and Winnipeg, a distance of 22 miles, is completed and in operation.

The line is erected, and has been operated from Livingstone to a point in longitude of Fort Edmonton. There is still, however, a considerable amount of work to be done, some inferior poles to be replaced, and some portions to be replaced. At present, it is only in operation as far as Battleford.

On the western Section, between Edmonton and the existing line in British Columbia, no portion of the line is completed, but a quantity of material has been ordered at points along the route.

GRADING, TRACK-LAYING, &c.

Fort William to English River, 113 miles.

From Fort William, westward, the roadbed of the railway is graded continuous, and the bridges erected to the 77th mile; beyond this point there is an estimate of four miles more graded in detached portions. The rails are laid for a distance of 41 miles, and of this about 36 miles are partially ballasted, and in fair running order.

English River to Keewatin (Rat Portage,) 184 miles.

The line has been located for construction between these points, but is not under construction.

Keewatin to Cross Lake, 36 miles.

From Keewatin, westward, for a distance of 23 miles, a considerable quantity of grading has been done, consisting chiefly of rock. From the 23th to the 36th mile, supplies are being delivered, but grading has not been commenced.

Cross Lake to Selkirk, 76 miles.

From Cross Lake, westward, for a distance of 11 miles, there has been no grading. From the 11th to the 43rd mile the grading is in various stages of progress, portions of the distance, in detached portions, being ready for track laying. From the 43rd to the 76th mile the grading and bridging are completed, and the roadbed is in good condition for tracklaying. The rails are laid, but not ballasted, for a distance of 11 miles eastward from Selkirk.

Pembina Branch.

The length of this branch is 84½ miles, extending southward from the main line at Selkirk to the International Boundary at Emerson. Between Selkirk and St. James, opposite Winnipeg, a distance of 22 miles has been graded during the past year, and the rails laid over the same, but it is not ballasted. From the 22nd to the 39th mile, no grading has been done. From the 29th mile to Emerson, the grading was completed in 1875, with the exception of the spaces left for bridges and trestles.

[1877]

ENGINE HOUSE.

A ten stall engine house has been completed at Fort William.

ENGINEERS' HOUSES.

At Fort William a good house has been built for the District Engineer, between that point and Selkirk, 18 smaller houses have been erected for the the Assistants on the line during construction, which, after the line is open for traffic, will come into use in connection with the stations.

FORT FRANCES LOCK.

The rock excavation is nearly completed. The timber for the gates will be cured during the winter. For description of this work, *vide* Report of 1876. Appendix p. 205-208.

CONTRACTS.

A schedule of contracts, with statement of expenditure upon the same during fiscal year ended 30th June, 1877, is appended.

I have the honour to be, Sir,

Your obedient servant,

MARCUS SMITH,
Acting Engineer in Chief.

F. BRAUN, Esq., Secretary,
Department Public Works.

SCHEDULE OF CONTRACTS with Statement of Expenditure upon the same, during the Fiscal Year ended 30th June, 1877.

CANADIAN PACIFIC RAILWAY.

Contract No.	Character of Works.	Date of Contract.	Name of Contractors.	Amount expended during Fiscal Year ended 30th June, 1877.
1	Construction of Telegraph Line, Fort Garry to Livingstone	1874.	Sifton, Glass & Co	\$ 35,760 80
2	do do Livingstone to Edmonton	Oct. 17	R. Fuller	32,414 95
3	do do Edmonton to British Columbia	do 30	P. J. Barnard	8,900 00
4	do do Lake Superior to Fort Garry	Nov. 10	Oliver, Davidson & Co	40,027 65
5	Pembina Branch { Grading	1874.	Joseph Whitehead	13,298 00
	{ Extension St. Boniface to Selkirk, Grading, Bridging and Tracklaying	Aug. 31		980 00
13	Fort William to Sunshine Creek, Grading and Bridging	1875.	Sifton & Ward	114,100 00
14	Red River to Cross Lake, Grading and Bridging	April 3	Sifton & Ward	130,470 00
	{ do do do	do 3		
15	{ Cross Lake to Rat Portage, Grading and Bridging	1877.	Sutton, Thompson & Whitehead	54,306 00
	{ (Red River to Rat Portage, Tracklaying and Ballasting	June 9		
23	Railway Sleepers No. 56,339	1875.	Sifton & Ward	3,669 79
	{ do do do	Oct. 4		
25	Sunshine Creek to English River, Grading and Bridging	1876.	Parcell & Ryan	335,800 00
26	Fort William to English River, Tracklaying and Ballasting	June 6	James Isbester	16,600 00
29	Ten Stall Engine House, at Fort William	July 17	Cooper, Fairman & Co	8,532 90
	{ Railway Spikes, 150 Tons, delivered at Fort William	July 28		
32	Railway Spikes.. { 200 tons delivered at Duluth	1877.	Cooper, Fairman & Co	13,647 50
	{ 50 do Fort William	May 12		

CANADA PACIFIC RAILWAY.

REPORT OF LOCATION SURVEY FROM YELLOWHEAD PASS TO BURRARD INLET.

OTTAWA, 19th December, 1877.

SIR,—I beg leave to submit the following description of the trial location survey of the line from Yellowhead Pass to Burrard Inlet made during the summer of 1877.

From the summit of Yellowhead Pass, to 38th mile westward the line is common to all the routes through British Columbia. Commencing at that point a trial location was made by the Rivers Albreda and Thompson, and the lower part of the River Fraser to Burrard Inlet.

The plans and profiles are as yet incomplete and the description here given may hereafter be somewhat modified.

Point of divergence to Cranberry Lake—38 to 58 miles.

For the first eight miles the work is in rock and heavy, the remainder consists of nine miles of light work and two of heavy, in sand and gravel. The principal stream to be crossed is McLennan's Creek, 100 feet wide. The alignment and grades are easy throughout.

Cranberry Lake to North Thompson—58 to 85 miles.

For three miles from Cranberry Lake to River Canoe the work is heavy, of the remaining distance, eight miles, may be classified as heavy, and the rest of the line varying from medium to light. The material is principally sand, gravel and boulders with about three miles in rock. River Canoe, 120 feet wide, River Camp 70 feet wide, and River Albreda 200 feet wide, have to be bridged. The grades are steep, the heaviest descent being in the Albreda valley where there is one stretch of 1 per 100 over 3 miles long, and two others, each upwards of a mile, and on these grades there are curves of 1,146 feet radius.

North Thompson Valley—85 to 102 miles.

Near the 85th mile, the line crosses the River Thompson with 300 feet of bridging, and then follows its west bank. Being to a large extent on the hill side, some sharp curvature has to be resorted to, four curves of 820 feet radius were used, but at such places the gradients are trifling, and are throughout, undulating and easy. The work may be classed as medium with the exception of one point, near the 86th mile, where the main mountain abuts on the river.

North Thompson Valley—102 to 120 miles.

For the first four miles, the line is on benches requiring heavy work. From that point forward it is on flats and the work is light except at a few places where the base of the hill is washed by the river, causing some rock spurs to be cut through. The principal streams to be bridged are Green River 75 feet, and Blue River 100 feet wide. The grades are light and undulating and curvature easy.

North Thompson Valley—120 to 130 miles.

This section is all on side hills, and embraces the canyon of the North Thompson four miles in length. The works are generally in rock and for six miles are very heavy, with one tunnel of 350 feet, and another of 150 feet long. Although the descent through the canyon is rapid, only $1\frac{1}{2}$ miles of 1 per 100 grade will be necessary. The sharpest curves are 1146 feet radius. No large streams are met.

North Thompson Valley—130 to 143 miles.

This section is on the flats adjoining the stretch of river known as Stillwater. Two rock spurs and one of gravel touch the river and have to be cut through, the rest of the work is almost exclusively embankment, and not heavy. No large structures are required. The grades and curves are light.

North Thompson Valley—143 to 164 miles.

RD INLET. Six miles of this are on side hills and require heavy work, one-third of which is in rock. The remaining 15 miles are on benches and flats, with medium works, principally in gravel and boulders. Several places have to be protected against encroachment of the river, and two points against earth sliding from above in the spring of the year. The grades are undulating, with four stretches of 1 per 100, the longest of which is common 1½ miles. To avoid tunnelling, a curve of 716 feet radius was used on a grade of 26 point a tri-foot per mile. Mad River, 60 feet wide, is the only stream of consequence to be crossed. part of the

North Thompson Valley continued to Clearwater—164 to 182 miles.

regiven may About four miles of this distance are on the steep side hill, close to the river, and require protection in many of the bays. There are about six miles of heavy work, principally in sand and gravel, the rest is light. Near the 171st mile the line crosses the North Thompson to its eastern principal streambank, which is then followed to Kamloops. This crossing is 350 feet wide, and no grades are other river of importance is met with on the section. The grades are easy and undulating, and the curvature is not serious.

Clearwater to Indian Reserve—182 to 206 miles.

heavy, of the Assiniboine Bluff and some other side hills abut on this part of the river, and st of the line some about eight miles of heavy work, a large proportion of which is in rock. The and boulders, other 16 miles may be classified as medium work. Curves and grades are easy. No 70 feet wide, the large streams have to be crossed. of 1 per 100 grades there

Indian Reserve to Head of Rapids—206 to 220 miles.

Most of this distance is on the flats next river, where work is light. 2½ miles of heavy work occur in sand and gravel. Some river protection is required. The only large stream to be bridged is the Barrière, 350 feet wide. The curves are easy, and grades light.

Head of Rapids to Kamloops—220 to 255 miles.

This section includes two side hills, one five miles and the other 3½ miles long, on which the work is heavy. The rest varies from medium to light. Near the 254th mile the South Thompson River, 300 feet wide, is crossed close to its confluence with the North Thompson. The grades and curves are light.

Kamloops to Savonas' Ferry—255 to 280 miles.

From that s where the ut through. ver 100 feet From Kamloops the line follows the Thompson River for seven miles, with easy work and gradients to Kamloops Lake. In following down the south shore of the lake, Cherry Creek bluff and some others of bold, irregular outline have to be passed, entailing six tunnels of a total length of 2,750 feet. The work along the lake is principally in rock, all of it heavy, and eight miles of it excessively so. In passing the bluffs it was found necessary to use curves of 955 feet radius, and gradients of 1 per 100 are of frequent occurrence. No large streams have to be crossed.

Savonas' Ferry to foot of Black Canyon—280 to 308 miles.

Thompson es are very hough the necessary. Of this distance six miles may be classified as light work. All the rest is on the face of benches adjacent to the River Thompson, causing heavy work, which requires protection from wash at many points. The proportion of rock work, however, is not large. Near the 307th mile a ridge of rock forming a sharp bend in the river necessitates a tunnel 550 feet in length. No large streams have to be crossed. Stillwater. Curves of 1,146 feet radius were frequently used. The grades are undulating and rough, the large struc- short, requiring in several instances 1 per 100.

Foot of Black Canyon to Spence's Bridge—308 to 327 miles.

This section is partially similar in character to that last described. Through nearly half of it the work is of a light character and the balance heavy, requiring river protection at many places. There is but little rock excavation. The curves are numerous, 955 feet radius being the sharpest. The grades undulate. Near the 326th mile the River Nicola, 300 feet wide, has to be bridged.

Spence's Bridge to Lytton—327 to 350 miles.

The valley of the River Thompson, for most of this distance, is narrow, and the line is located along the face of steep side hills, advantage being taken of benches at a few points where available. The work may be classified as heavy, with a large proportion in sand, gravel and boulders. The River Nicomen, 150 feet wide, and a few rocky ravines, are the only places requiring structures of importance. Several curves of 1,146 feet, and two of 955 feet radius, represent the heaviest curvature. The grades are undulating and easy, there being but one mile of 1 per 100.

The worst feature in this section is a sort of mud glacier, met with near the 333rd mile, known as the "Mud Slide."

At the point where the line crosses, it is about 1,000 feet wide and slides forward at the rate of about 8 feet per annum, a movement which mostly occurs in spring. This movement is greatest at the centre and decreases towards the sides. The whole presents a rugged broken face, about 50 feet high at the River Thompson, where it breaks off and is washed away at time of freshet.

The head of this slide is about two miles from the line and 1,900 feet above it and it seems to be caused by springs in that neighbourhood which disappear into the ground and re-appear again at intervals, making the earth, which is strongly impregnated with alkali, dissolve to the consistency of soap, and thus form a lubricator between the bed rock and the mass of earth above. It is hoped, however, that by careful drainage of the springs near their sources, and by diverting them elsewhere the slide can be so far stopped as to avoid any extraordinary expenditure for maintaining the work.

Lytton to Crossing of the River Fraser—350 to 356 miles.

The line descends gently on sand and gravel benches, with heavy work and much curvature for $5\frac{3}{4}$ miles. It then crosses over to the right bank of the River Fraser and continues down that side all the way to Burrard Inlet. The crossing of the Fraser is 500 feet wide at formation level, and about 120 feet above low water mark. Immediately after passing the River and on the same straight line, there is a tunnel 600 feet long through a rock bluff.

Crossing of the River Fraser to Boston Bar—356 to 379 miles.

The work is heavy throughout this section, being in rock for upwards of one third of the distance. The Na-ah-latch River, 120 feet wide, and about 12 large ravines have to be crossed. The curves are numerous, but none sharper than 1,146 feet radius. The grades undulate and the maximum 1 per 100 has often to be introduced.

Boston Bar to Yale—379 to 403 miles.

At Boston Bar the line enters the canyons of the River Fraser, which extend to Yale. Five miles of the distance is over benches with medium work, and the rest on a broken rocky side hill, or along the face of almost perpendicular bluffs, entailing heavy rock excavation, and ten tunnels, the united length of which is about 5,650 feet ($= 1.07$ miles) the longest being 1,550 feet. The largest streams on this section are the Skuzzum about 80 feet, the Spuzzum about 100 feet wide, and three other smaller streams. There is one curve near Yale of 820 feet radius on a level; with this exception 1,146 feet is the shortest radius used. The grades undulate and there are about seven miles of 1 per 100. Near the 384th mile is a ravine, down which snow sometimes slides, but as the grade is high and requires a bridge at this point, the snow can pass underneath, and no danger need be apprehended.

Yale to Sister Rocks—403 to 413 miles.

The work is moderate, being chiefly on gravel benches, with easy, undulating gradients and a small percentage of curvature; five creeks have to be bridged, which vary in width from 40 to 80 feet.

Sister Rocks to flat below Hope—413 to 419 miles.

From the Sister Rocks, for a distance of six miles to a flat three miles below Hope, the work is heavy, with a considerable number of sharp curves on undulating gradients, principally 1 per 100. There are three short tunnels, amounting in the aggregate to 1,275 feet.

Flat below Hope to Harrison River—419 to 444 miles.

The work on this section is moderate, four-fifths of it being on benches and flats, and the remainder along bluffy and broken side-hill, with one tunnel 230 feet in length. One creek 100 feet wide has to be crossed. At the time of high water the toe of embankments will be subject to flood at several points, but no apprehension need be felt as to stability of line, as these banks will be of rock, and in no case subject to wash.

Harrison River to St. Mary's Mission—444 to 462 miles.

Eleven miles of this work varies from medium to heavy, with a small proportion of rock, the other seven miles are on a low flat, liable to an overflow at extreme flood of from three feet to twelve feet, entailing heavy works. The principal streams to be bridged are the Harrison, with a waterway of 900 feet, and an extreme depth of 27 feet; the Hatzic, 140 feet wide, varying from 6 feet to 14 feet in depth; and one other stream 100 feet wide. The grades are undulating, and curves easy.

St. Mary's Mission to Pitt Meadows—462 to 482 miles.

Five miles of this may be classified as medium, the remaining distance heavy, with little rock. River Stave, 100 feet wide and 20 feet deep at centre, with Kanaka Creek 400 feet wide, are the largest rivers to be crossed. The alignment and grades are easy.

Pitt Meadows to Port Moody—482 to 493 miles.

This section includes the Pitt Meadows, which are four miles wide and subject to an overflow at extreme flood of about seven feet in depth, requiring expensive works of construction. The remainder of the work varies from medium to light, without rock excavation, so far as known. Where the line crosses the River Pitt, it is 1,000 feet wide, and varies from five to 45 feet in depth. The Coquitlam, 200 feet wide, is the only other stream of importance. The curves are easy and the grades light.

To extend the line from Port Moody to English Bay, along the southern shore of Burrard Inlet, the distance is 15 miles. Many sharp, rocky spurs extend to the water's edge, entailing heavy cuttings with a large percentage of rock. The grades are easy and the curves light.

From the foregoing it will appear that 1 per 100 is the maximum gradient used and some of the heaviest works met with in the exploratory surveys have been considerably reduced; the aggregate length of tunnelling being now a little over 2½ miles. A considerable portion of these reductions, however, has been effected by introducing more curvature, and using sharper curves at certain points than had heretofore been employed, one of these being 716 feet radius and several 820 feet radius, but they were used only in localities where the line is level or the gradients of trifling ascent.

The subjoined statements apply to the line from the 38th mile to Port Moody, and afford information which cannot claim to be strictly accurate, owing to the incomplete state of the profiles.

Level.

There are 157 miles of line practically level—a portion being on a grade of less than five feet per mile.

Maximum Grade of 1 per 100.

Of this grade there are—

	Miles.
65 stretches ascending east, amounting to.....	46 ⁸³ ₁₀₀
34 stretches ascending west, amounting to	27 ¹⁰⁵ ₁₀₀
The longest ascending east is a little under.....	31 ² ₂
The longest ascending west is a little under.....	5 ³ ₄

Classification of Work.

43 miles may be styled excessively heavy, 106 miles moderate and 60 miles light.

Waterway of Rivers to be crossed.

1	River	1,600 feet in width.
1	"	1,400 feet in width.
1	"	900 feet in width.
3	"	varying from 350 to 400 feet in width.
5	"	" 250 to 300 "
2	"	" 160 to 200 "
8	"	" 100 to 150 "
7	"	" 60 to 90 "
2	"	" 30 to 50 "

In passing the Cascade Mountains on this route the ravine near the 384th mile already referred to, is the only place where snow is now known to slide from any considerable height across the proposed line of railway. Heavy drifts occur at various points where the configuration of the ground favors their formation, and will entail the construction of snow sheds. The hill sides were carefully examined for traces of avalanches, but none were found, and this result was corroborated by the testimony of people residing in the neighbourhood who travel the road continually, no danger therefore, need be anticipated from that source. On that portion of the line, however, in the Fraser Valley above the Tête Jaune Cache the mountain sides are very steep, and are grooved at places by avalanches of snow, timber and loose rock.

The maps and sections are being completed with as much despatch as possible in order that exact and precise information with regard to the route be submitted at an early date.

I have the honor to be, Sir,

Your obedient servant,

H. J. CAMBIE,

*Deputy Engineer in Charge
Surveys,
British Columbia.*

MARCUS SMITH, Esq.,
Acting Engineer-in-Chief,
Ottawa.

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